Reconciling Expansion of Restorative Burning with Protecting Public Health from Smoke Impacts

Interagency Air And Smoke Council (IASC)

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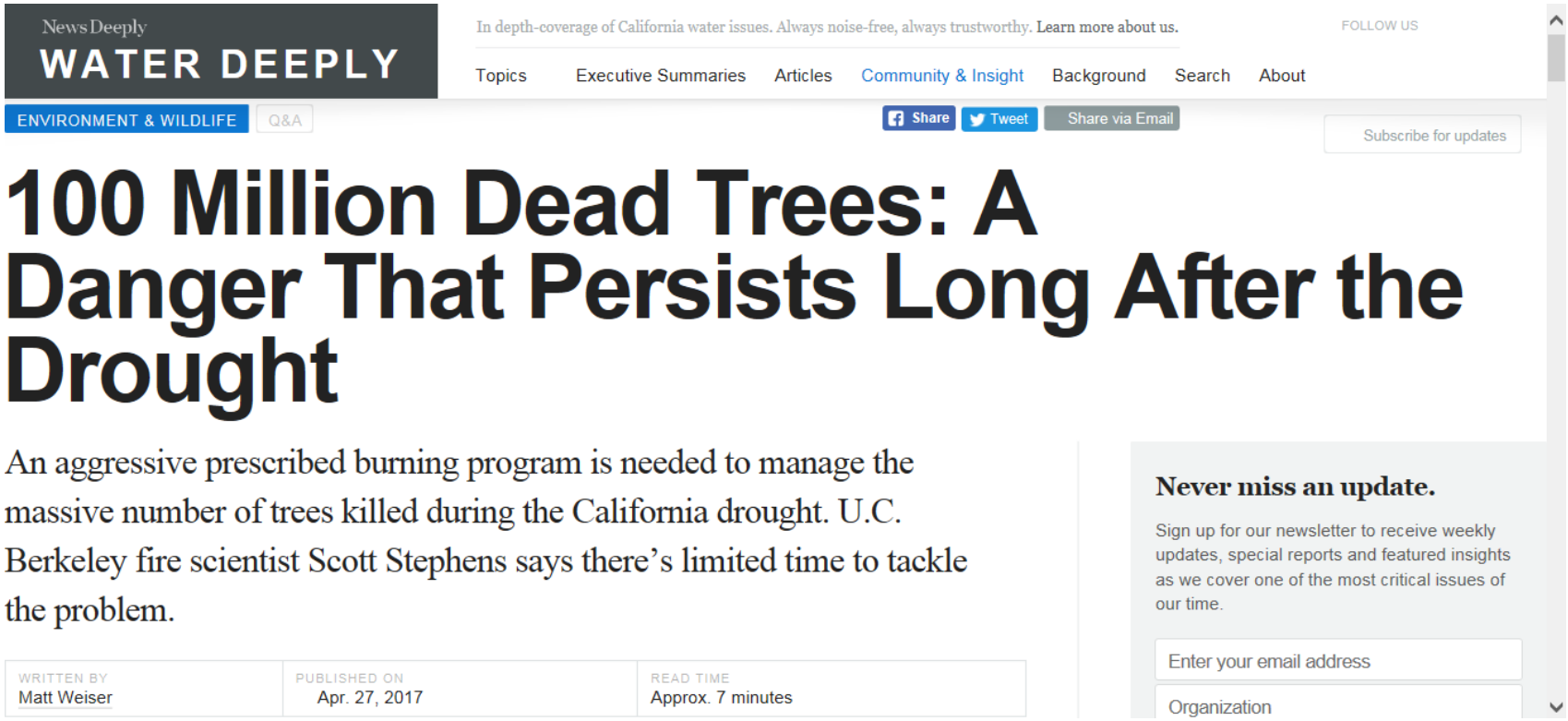
Jonathan Long
Ecologist
Forest Service
Pacific Northwest Research Station,
Davis, CA
p: 530-759-1744
c: 530-902-2759
jwlong@fs.fed.us

Leland Tarnay
Physical Ecologist
Land-Atmosphere Interactions
Forest Service
Region 5 Remote Sensing Lab
p: 530-587-3558 ext.260
c: 530-227-8811
ltarnay@fs.fed.us

Possible Response to Tree Mortality

Scott Stephens (UC Berkeley): “If you’re not going to remove these trees mechanically…you begin to work by going in there [after the needles fall] and burning out the understory fuels. And then as more and bigger material starts coming down from all those dead trees, in 10 years or 15 years, you do it again. You’re taking out the accumulated fuel in layers.”



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100 Million Dead Trees: A Danger That Persists Long After the Drought

An aggressive prescribed burning program is needed to manage the massive number of trees killed during the California drought. U.C. Berkeley fire scientist Scott Stephens says there’s limited time to tackle the problem.

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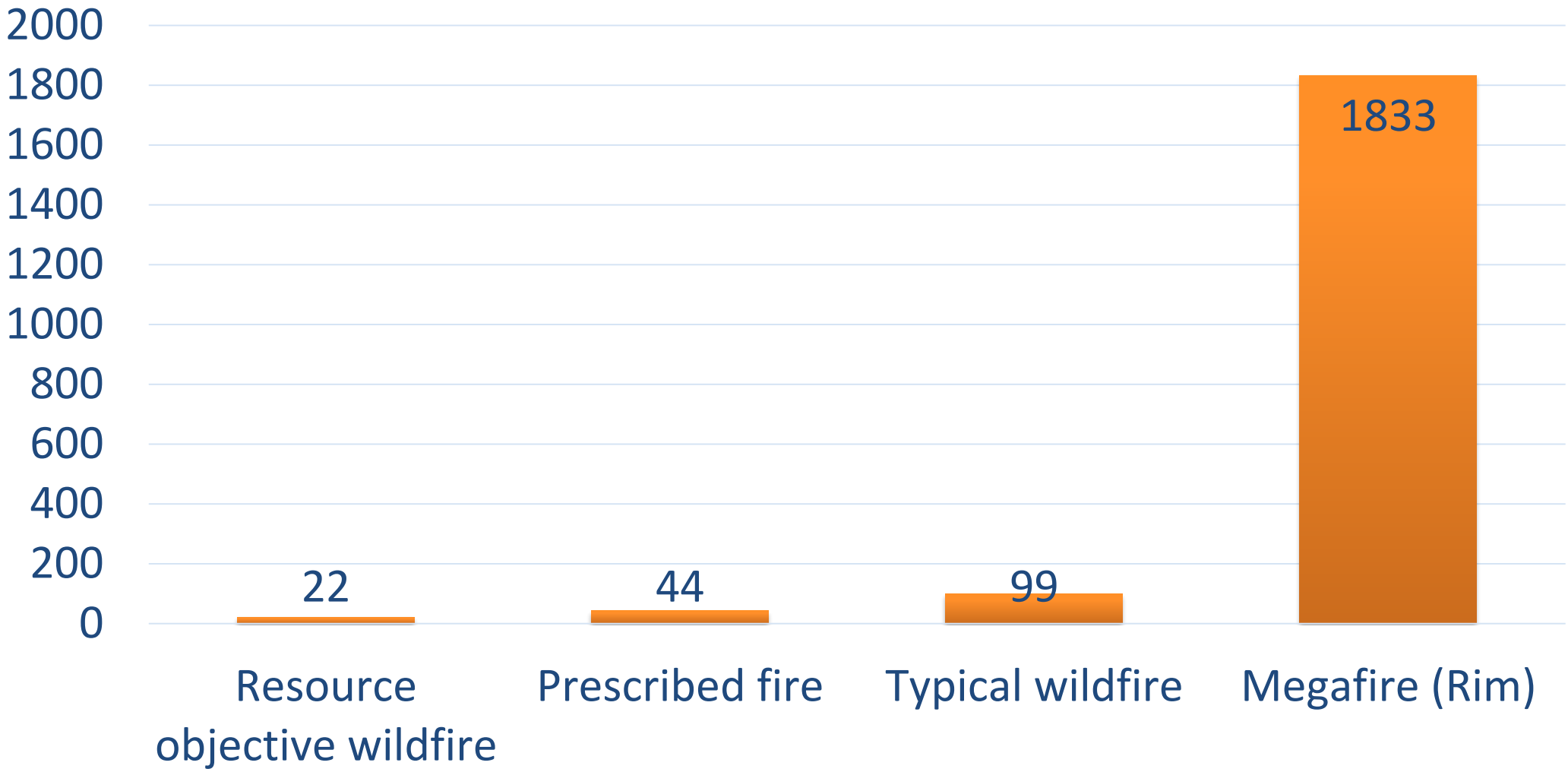
Key Questions for Addressing Public Health Impacts of Restorative Burning

1. What is an appropriate framework for evaluating smoke impacts and tradeoffs?
2. How could shifting to more frequent use of resource objective fires help to reduce smoke impacts?
3. What policy incentives might help increase area burned while mitigating smoke impacts?
4. What are strategies and tactics for using fire while minimizing smoke impacts?

1. Framework for Evaluating Smoke Impacts

1) daily emissions	2) conveyance to downwind communities	3) size and vulnerability of those communities
		

Average daily emissions ($PM_{2.5}$/day) by fire type in a 10 year analysis from Yosemite National Park



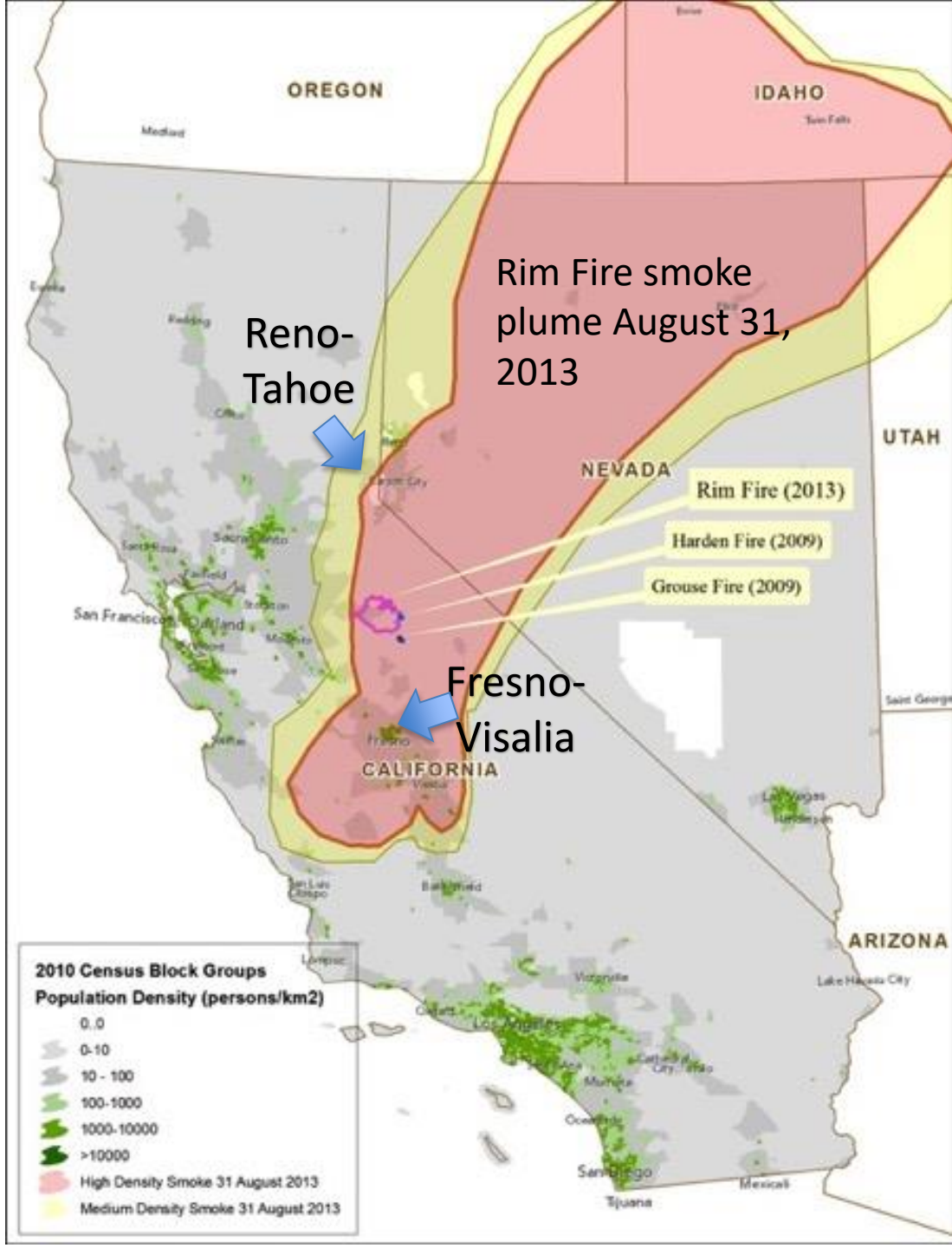
Applying a smoke impacts framework demonstrates enormous impacts of extreme fires

Method:
Populations under maps of smoke plumes weighted by probability of a statistically significant increase in PM2.5 at ground monitoring stations

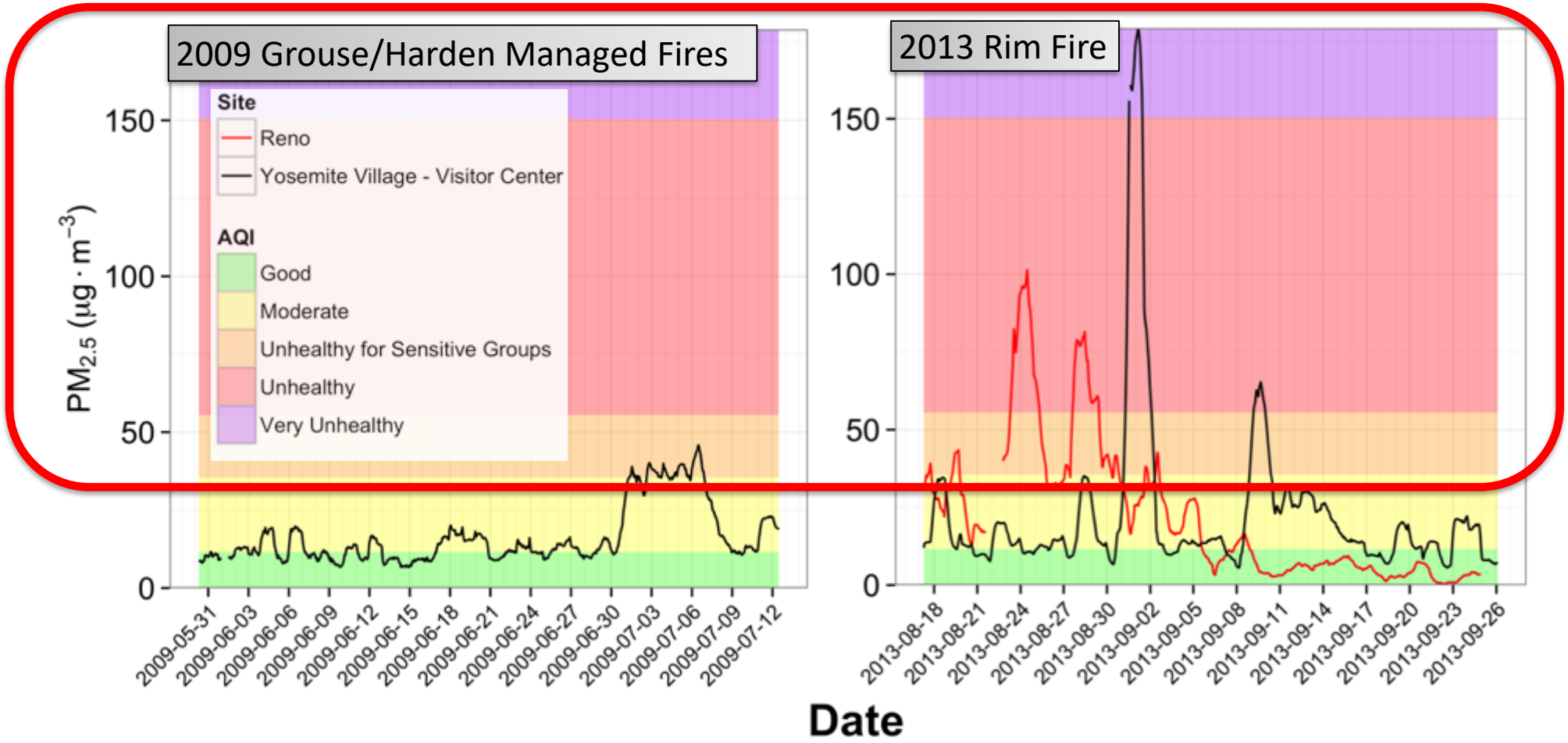
Rim Fire estimated impact:

7 million person-days of smoke impact (especially in Reno-Tahoe area)

Over **5.5 X** more impact per unit area burned as two managed fires in the same airshed

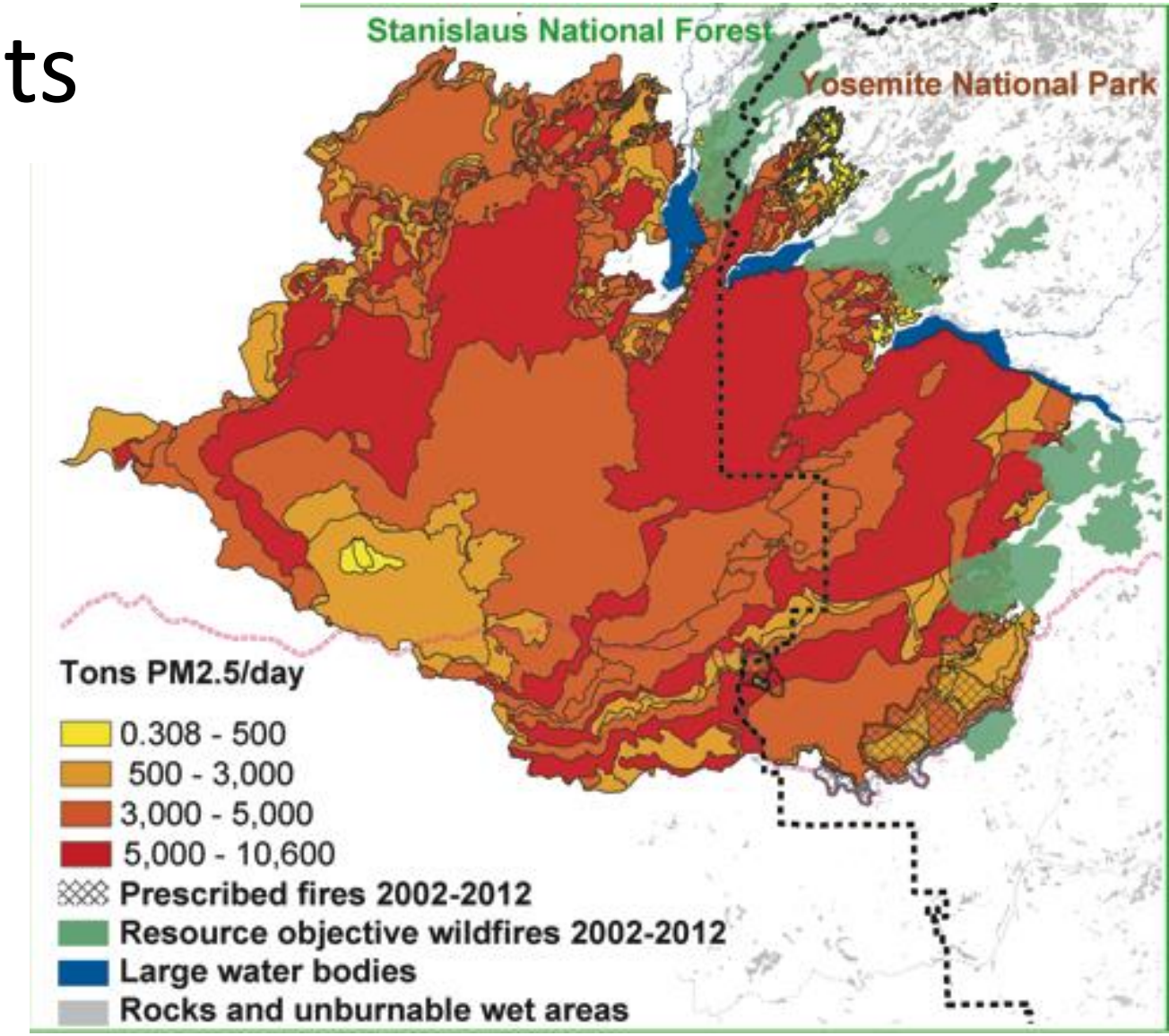


Using the right tactics under favorable dispersion, **large areas can be burned** with limited smoke impacts on downwind communities



2. How Resource Objective Fires Reduce Smoke Impacts

1. Reduction of fuels and consumption
2. More favorable dispersion
3. Greater ability to regulate fire spread per unit time (using “push-pull” tactics)
4. Creation of anchors that facilitate future fire management
5. Advance planning, notification, and opportunities to mitigate exposure



Rate of spread and size cause emissions per day to vary greatly

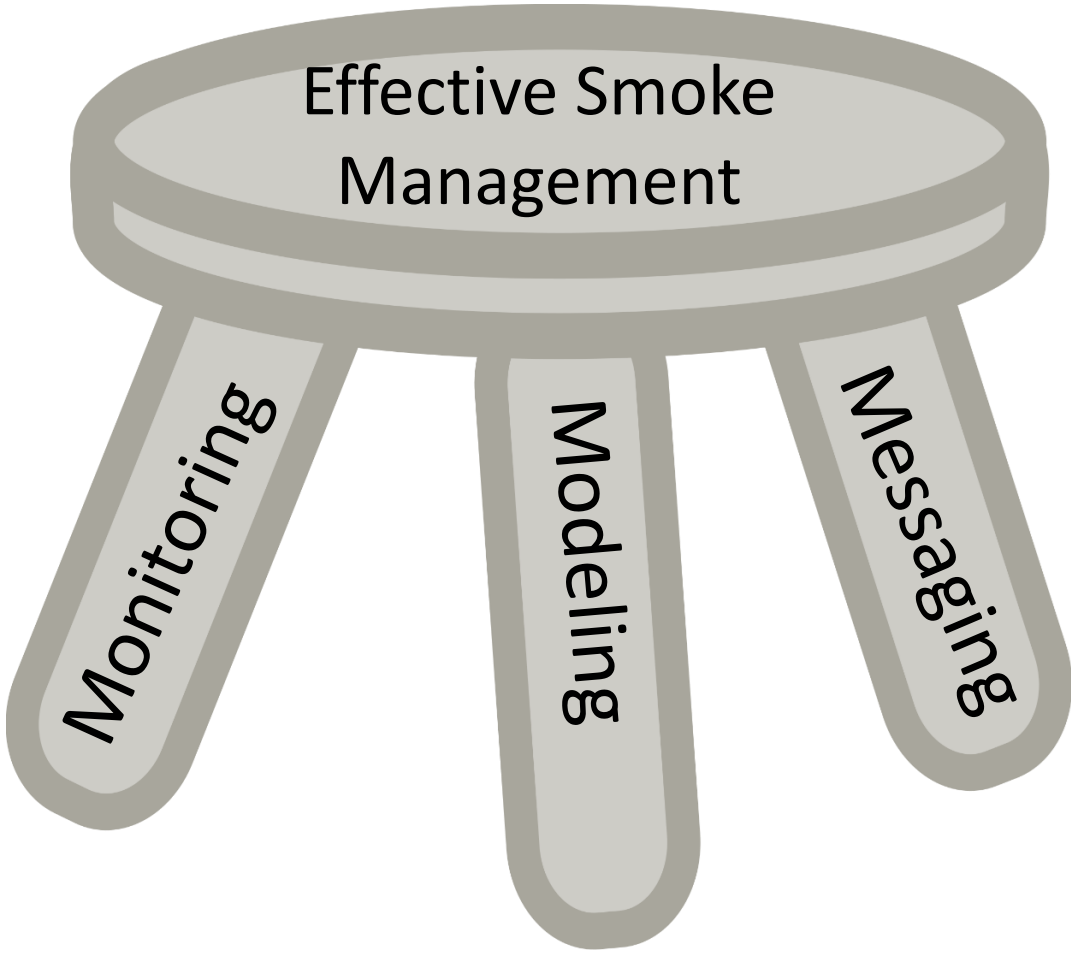
3. Aligning Incentives to Reduce Smoke Impacts while Increasing Area Burned

1. Avoiding area-based constraints and policies: for example, applying flat fees for restorative burning rather than charging per acre burned
2. Providing for exceptional events exceedances for resource objective fires when needed
3. Supporting landscape-scale resource objective burns with air resource advisors
4. Aligning public information and firefighting resources to use expected burn windows

Resource objective fires planned to burn 600-1000 acres at ~50 tons/acre fuels could emit <500 tons/day with minor impacts under good dispersion

4) Strategies and tactics for using fire while minimizing smoke impacts

- Planning where to burn
  - Targeting gaps between recently burned areas
  - Designing placement of mechanical, manual, prescribed burning, resource objective wildfire to “containerize” the landscape
  - Considering areas of tree mortality
- Planning when to burn
  - Evaluating burn window patterns and constraints
  - Considering spring versus fall opportunities, constraints and effects
  - Considering “snow-off”



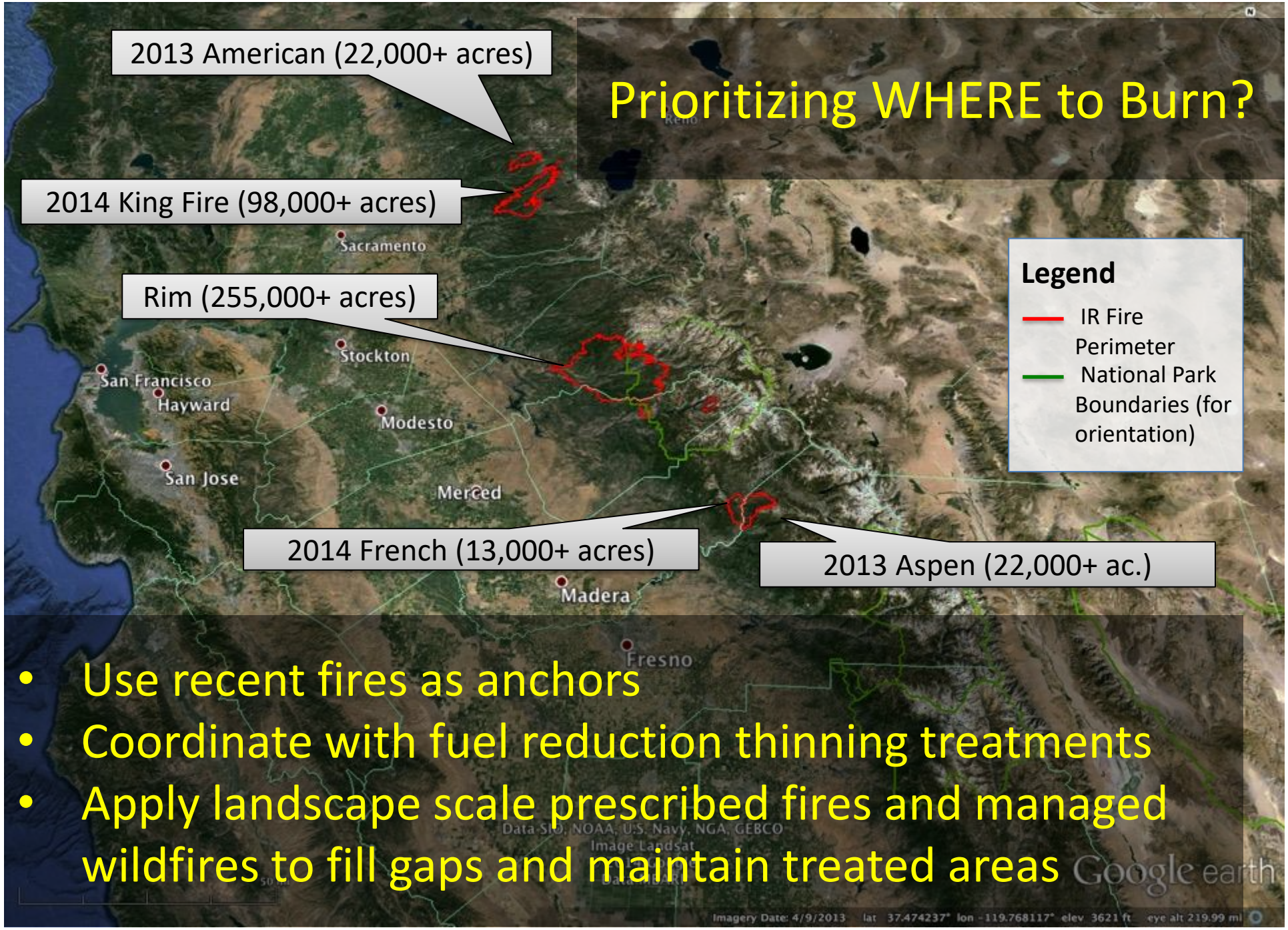
Unusual departures from natural range of variation may increase need for

- Protective pre-treatments to facilitate above-ground survival of trees when fire is introduced
  - Treatments that are outside of natural burn window (i.e., more spring burning)
  - Reliance on mechanical treatments to reduce fuel loads prior to fire

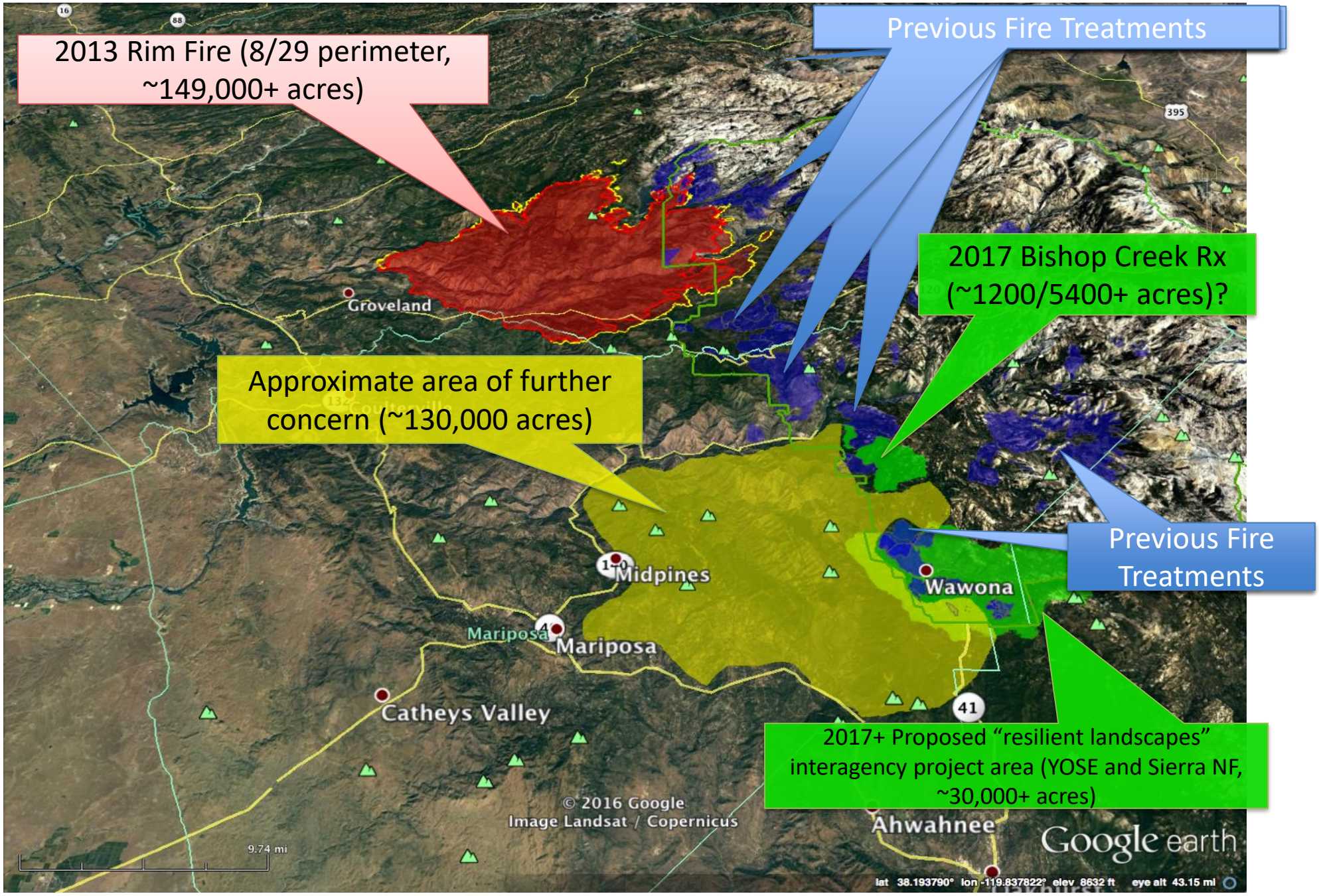
Key Challenges

- Strategic planning and analyses will be important for staging multiple treatments efforts over large areas
- Systematically evaluating constraints on burning at landscape scales (e.g., smoke, wildlife, access, resources, etc.?)

SUPPLEMENTAL SLIDES

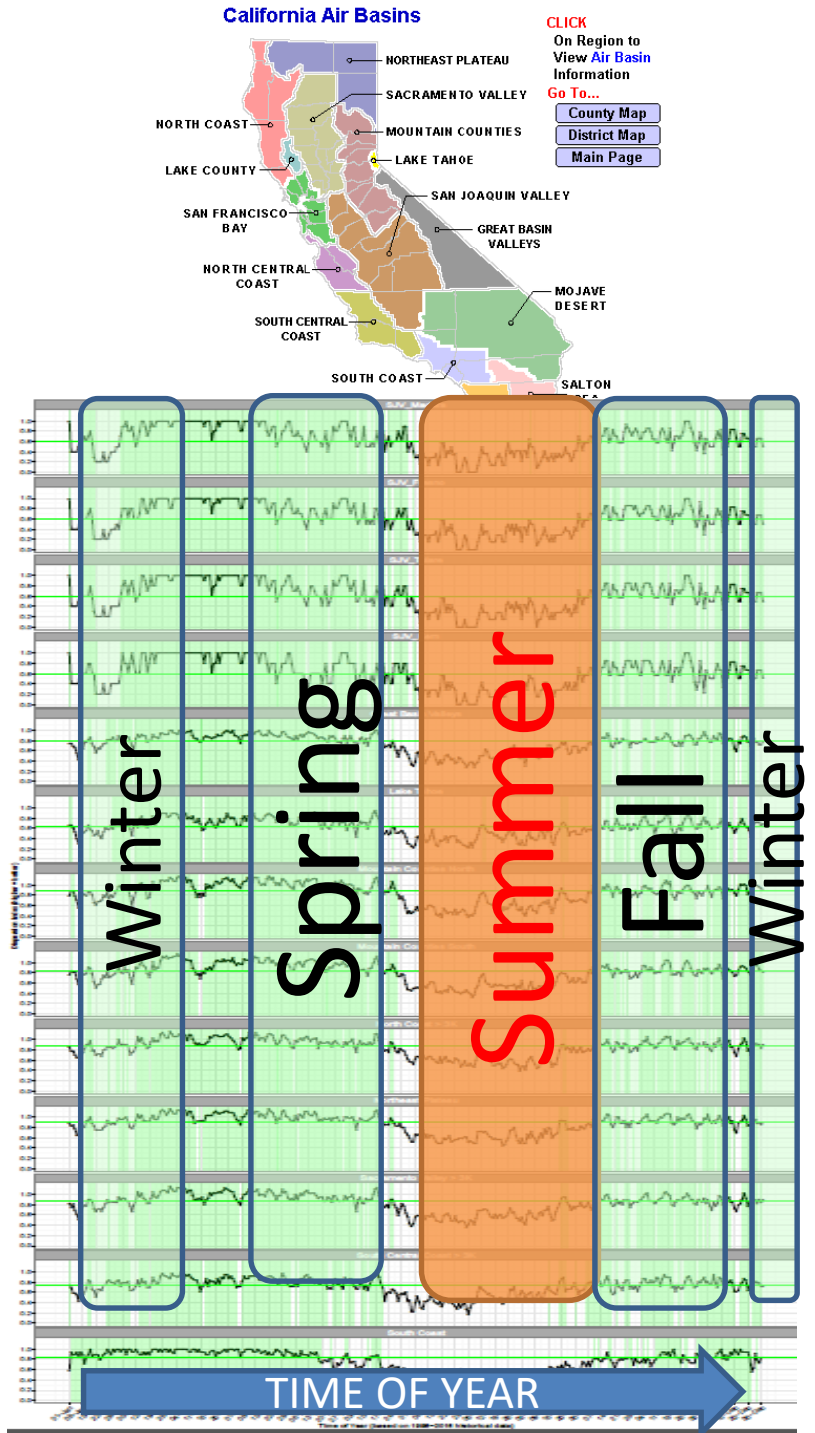

2013 American (22,000+ acres)
Prioritizing WHERE to Burn?
2014 King Fire (98,000+ acres)
Sacramento
Rim (255,000+ acres)
Stockton
San Francisco
Hayward
Modesto
San Jose
Merced
Legend
IR Fire Perimeter
National Park Boundaries (for orientation)
2014 French (13,000+ acres)
2013 Aspen (22,000+ ac.)
Madera
Fresno
Use recent fires as anchors
Coordinate with fuel reduction thinning treatments
Apply landscape scale prescribed fires and managed wildfires to fill gaps and maintain treated areas
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat
Google earth
Imagery Date: 4/9/2013 lat 37.474237° lon -119.768117° elev 3621 ft eye alt 219.99 mi

Potential Large-scale Burning in Yosemite/Sierra NF

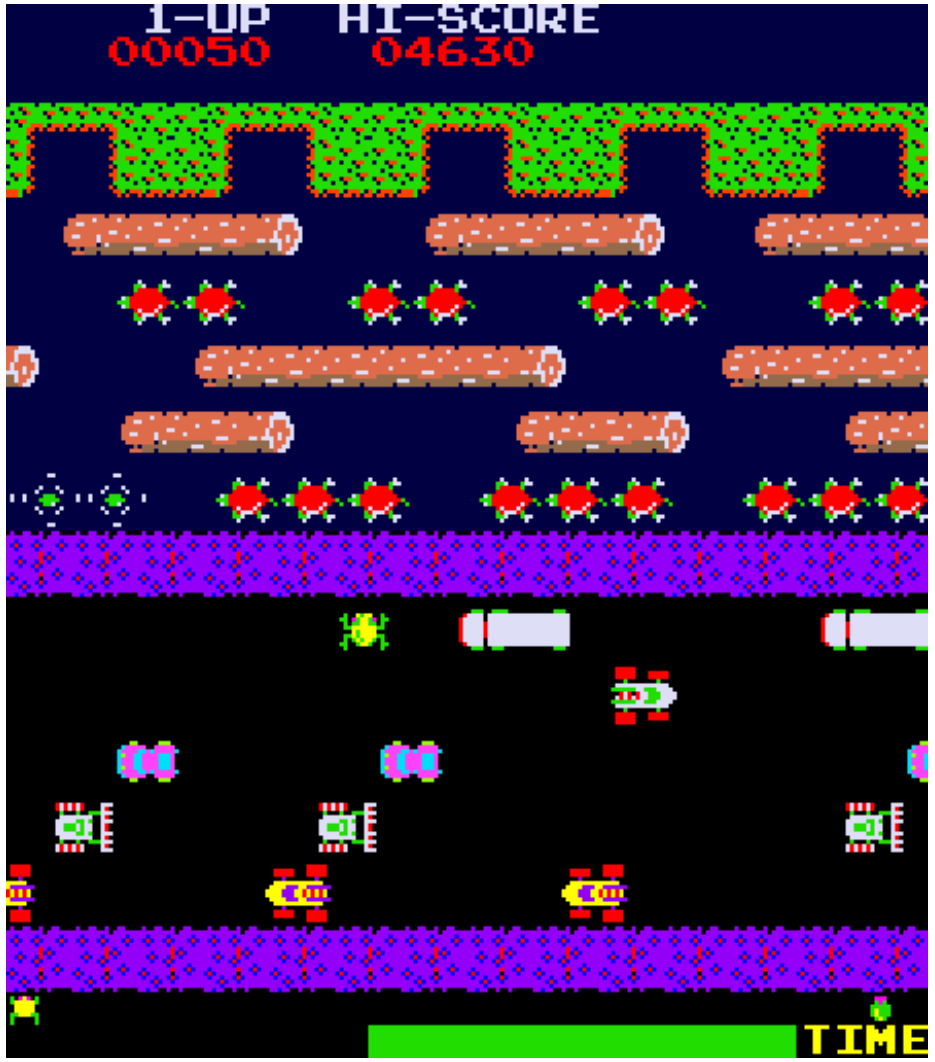


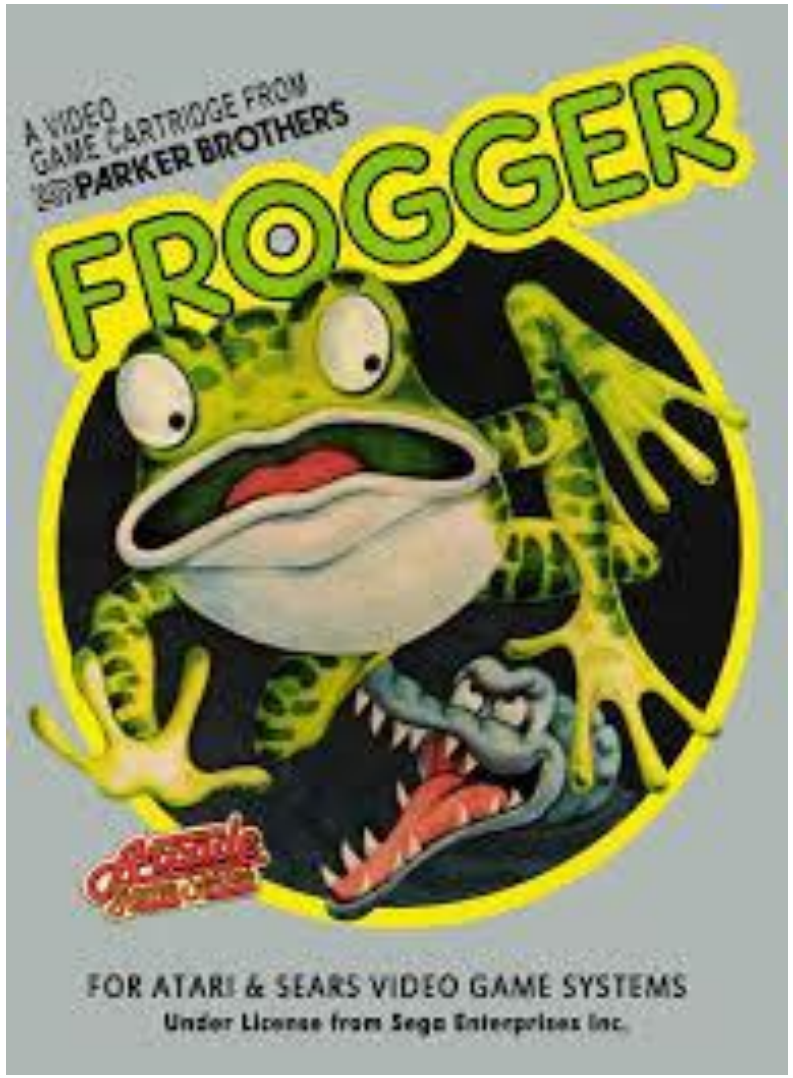
Prioritizing **When** to Burn?

- Some times have been consistent burn days historically (when black line nears top of graph, highlighted in dark green)!
- Dispersion best in spring and fall across California air basins
  - Late Feb and March
  - Most of April
  - Late May and Early June
  - Late Sept/Early Oct
  - Mid October and November (spotty)



Overcoming Challenges to Landscape-Scale Restorative Burning





GOAL: Restored Ecosystem

EXECUTION

Complaints

Availability of crews

- **Temporary employees available**
- **Outside of training**
- **On call for or resting from suppression**

Competition for airshed

Burn bans

Suitable moisture and wind

Resource Objective Wildfire

PERMITTING

Limited Operating Periods
(Fisher Owl Goshawk Frog Migratory Birds)

Air quality: burn day windows available for expected emissions

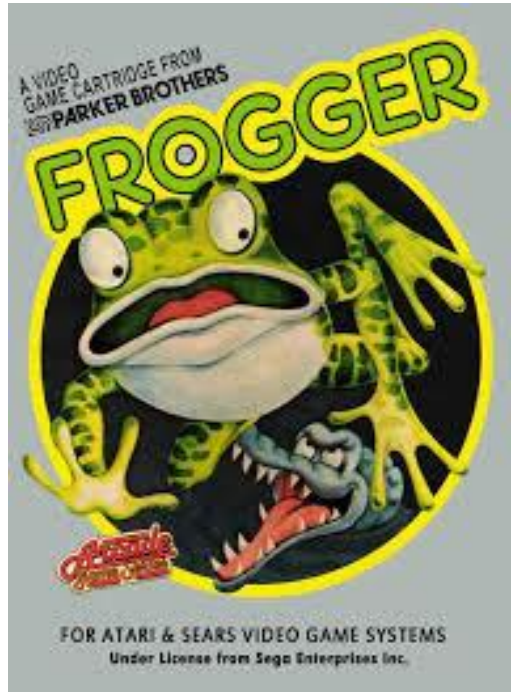
- **May need 3-5 continuous days for large burns**
- **Typically spring and some fall periods are best bets for restorative burns**

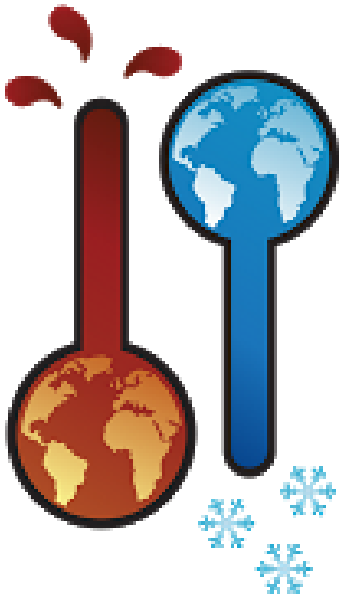
NEPA and future fires dictate time constraint

Climate Change

- Greater likelihood of smoke “waves” of extended harm*
- Narrower burn windows?
- Longer fire seasons→more smoke fatigue?
- Greater risk to using managed fire?

ADVANCED VERSION!





Liu et al. 2016, “Particulate air pollution from wildfires in the Western US under climate change”, *Climatic Change 138(3):655–666.*